

Original Article

**Association of dietary fiber with high sensitivity
C-reactive protein in type 2 diabetes mellitus**

I A Begum¹, M Sen², S F Afrin³, S S Moutoshi⁴, M A Islam⁵, M H Rahman⁶

Abstract:

Introduction: Hs-CRP is a nonspecific marker of the inflammatory response has been associated with development of type 2 diabetes mellitus. Cardiovascular disease is a major consequence of diabetes. DM confers a 2-4 fold rise in cardiovascular risk compared with general population. One of the many modifiable risk factors for both cardiovascular disease and diabetes is diet. Fiber is an important dietary factor that may modify the risk of both diseases. **Material & methods:** The current study is an attempt to explore the association of dietary fiber on inflammatory marker, hs-CRP in type 2 diabetic subjects. Total 80 diabetic subjects were included in this study of which 40 were taking more dietary fiber and 40 were taking relatively low dietary fiber. Serum hs-CRP was measured by chemiluminescent immunometric assay (DPC Biermann GmbH., Germany). Nutrient information was calculated using a pretested food recall questionnaire prepared by nutritionists for usual Bangladeshi food articles. **Results:** Hs-CRP was significantly higher in subjects taking low dietary fiber. There was significant negative correlation between CRP of subjects taking high and low intake of dietary fiber. **Conclusion:** So, low dietary fiber consumption maybe a possible causal factor of raised CRP. Type 2 diabetic patients who took less dietary fiber in their diets had elevated blood CRP levels.

Key words: Hs-CRP: High sensitivity C- reactive protein, Dietary fiber, T2DM: Type 2 Diabetes Mellitus.

Introduction

Diabetes mellitus is a fast expanding global health problem. Hs-CRP is a nonspecific marker of the inflammatory response has been associated with development of type 2 diabetes mellitus. In type 2 diabetes mellitus increased hs- CRP was found¹. Cardiovascular disease is a major consequence of diabetes. DM confers a 2-4 fold rise in cardiovascular risk compared with general population². Further more cardiovascular morbidity and mortality is increase in patients with elevated CRP levels³. C-reactive protein (CRP) is a marker of inflammation recently recognized as an independent predictor of future coronary heart disease⁴⁻⁸. Based on data from the 1988 to 1994 third National Health and Nutrition Examination Survey (NHANES III), the prevalence of elevated CRP concentrations (>3.0 mg/L) was 13.7% for men and 27.3% for women⁹. Lifestyle factors that influence CRP concentrations may provide an important intervention opportunity to reduce

the risk of cardiovascular disease, diabetes, and their complications. One of the many modifiable risk factors for both cardiovascular disease and diabetes is diet. Fiber is an important dietary factor that may modify the risk of both diseases¹⁰⁻¹⁴. Dietary fiber intake is associated with decreased oxidation of lipids, which in turn is associated with decreased inflammation¹⁵. It has been postulated that a low-fiber diet with highly refined carbohydrates can contribute to hyperglycemia, which increases the proinflammatory cytokines plasma interleukin (IL) 6 (IL-6), tumor necrosis factor?, and IL-18¹⁶. IL-6 is a primary determinant of CRP production; thus, consistently elevated concentrations of IL-6 might result in elevated CRP concentrations. Again, chronic low grade inflammation in diabetes is associated with the dietary pattern. On the contrary, in a cross-sectional study among British population¹⁷, a dietary pattern characterized by high intake of fruits and vegetables was inversely associated with features of metabolic

1. Dr. Ismat Ara Begum, Assistant professor of Biochemistry, Popular Medical College, Dhaka.
2. Dr. Moushumi Sen, Assistant professor of Biochemistry, Anwer Khan Modern Medical College, Dhaka.
3. Dr. Syeda Fahmida Afrin, Assistant professor of Biochemistry, Ibn Sina Medical College, Dhaka.
4. Dr. Shafia Sharmin Moutoshi, Assistant professor of Biochemistry, Holly Family Red Crescent Medical College, Dhaka.
5. Dr. Md. Ashraf Islam, Resident, Orthopaedics, Bangabandhu Sheikh Mujib Medical University, Dhaka.
6. Dr. Md. Hasanur Rahman, Associate consultant, Ibrahim Cardiac Hospital & Research centre, Dhaka

Corresponds to: Dr. Ismat Ara Begum, Assistant professor of Biochemistry, Popular Medical College, Road-2, House-25, Dhanmondi, Dhaka. Email: dr_ismatara@yahoo.com.

syndrome. We already know some benefits of dietary fibers to human health. It seems that the ingestion of fibers also brings benefits in inflammatory processes¹⁸⁻²⁰ that have been associated with chronic disorders such as the metabolic syndrome (MS), obesity, type² *diabetes mellitus* (T2DM), cancer and cardiovascular diseases (CVD)^{21,22}. The current study was an attempt to explore the association of dietary fiber on inflammatory marker, hs-CRP in type 2 diabetic subjects. The objective of the study was to find out the influence of diet in CRP level in type 2 diabetes mellitus.

Materials and Methods: Bangladeshi subjects were selected purposively from the Out-Patient Department (OPD) of BIRDEM. Type 2 diabetes mellitus was diagnosed based on the criteria of WHO (defined as fasting blood glucose \geq 7.0 mmol/L (126 mg/dl) 2-h postprandial glucose \geq 11.1 mmol/L (200 mg/dl). Informed written consent was taken from each subject. With all aseptic precaution, fasting venous blood (6 ml) was taken from each subject. The sera of selected subjects were aliquoted and kept frozen at -70°C until analysis. Serum hs-CRP was assayed by chemiluminescent immunometric method (DPC Biermann GmbH., Germany). Nutrient information was calculated using a pretested food recall questionnaire prepared by nutritionists for usual Bangladeshi food articles. The consumption was recorded on a weekly, monthly and more than a month basis. Data analysis of the dietary

parameters was carried out using software developed and previously used in the research studies using standard nutrients values of Bangladeshi foods. Dietary history was taken by means of dietary recall. Here a questionnaire, prepared by the nutritionists was introduced which dealt with dietary habits, frequency of eating and type of cooking medium. The consumptions of carbohydrate, protein, fat and dietary fiber were recorded on a daily, weekly and monthly basis. Dietary parameters were analyzed by special software. Statistical analysis was done by SPSS (version 12). All the data were expressed as mean \pm SD (standard deviation), median (range) as appropriate. The statistical significance of differences between the values were assessed by *t*-test and Mann-Whitney *u*-test (as appropriate). Correlation was also analyzed among the parameters. A two-tailed *p*-value of <0.05 was considered statistically significant.

The Research Prol The research protocol was approved by 'Ethics Committee' of BIRDEM.

Results and observations: A total 80 diabetic subjects were included in this study of which 40 were taking more dietary fiber and 40 were taking relatively low dietary fiber. In Tables I and II, hs-CRP was significantly ($p=0.000$) higher in subjects taking low dietary fiber. There was significant negative correlation found between CRP of subjects taking high, and low intakes of dietary fiber.

Table I: Composition of Dietary Intakes of the study subjects.

Variable	Patient taking high fiber (n = 40)	Patient taking low fiber (n = 40)	t/p value
CRP (mg/l)	7.3 \pm 8.6	17.4 \pm 20	12.621/0.000
T. Calorie (Kcal/d)	3877 \pm 1499	4543 \pm 1411	2.047/0.044
Carbohydrate (gm/d)	272 \pm 83.7	307 \pm 62.9	2.138/0.036
Protein (gm/d)	74.6 \pm 23.8	83.5 \pm 23.7	1.677/0.097
Fat (gm/d)	322 \pm 138	379 \pm 111	2.027/0.046
Dietary Fiber (gm/d)	16.8 \pm 3.7	7.1 \pm 3	12.627/0.000

Results were expressed as Mean \pm SD as appropriate *t*-test was performed as the test of significance at 5% level of significance level. n = number of subjects

Table II: Total calorie & macronutrients intake of the study subjects.

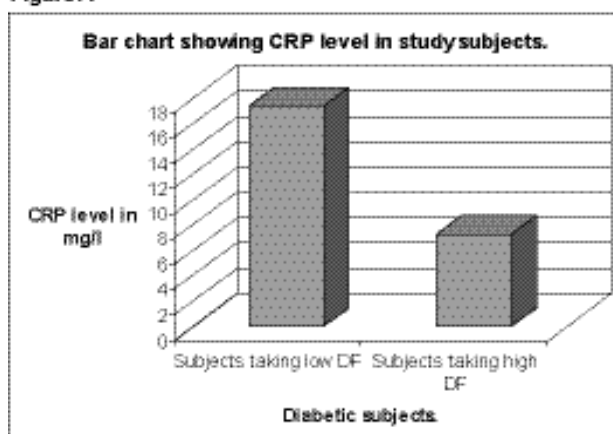
Variable	Patients taking high fiber(n = 40)	Patients taking low fiber(n = 40)	z/p value
CRP (mg/dl)	4.4 (1.2-49.4)	12.4 (2.4-127)	4.735/0.000
T. calorie (Kcal/d)	3568 (1597-8675)	4320 (2349-7765)	2.440/0.015
CHO (gm/d)	235 (132-443)	324 (178-420)	2.084/0.037
Protein (gm/d)	75(30-120)	85 (32-176)	1.401/0.161
Fat (gm/d)	324 (80-620)	358 (213-654)	1.699/0.089
Dietary fiber (gm/d)	16.4(2.8-25)	6.8 (3-16.4)	7.108/0.000

Results are expressed as median (range); Mann-Whitney 'u' test was performed as the test of significance at 5% significance level. n = number of subjects

Table III: Relation of CRP with different parameters of the study subjects

Variables	r value	p value
High and low intake of dietary fiber	-0.533 ^{***}	0.000
T. caloric	0.185	0.100
CHO	0.108	0.339
Protein	0.259 ^{**}	0.021
Fat	0.099	0.382

Results were expressed as correlation coefficient (Spearman rho) r values;

Figure: I

Discussion: Hs- CRP is now well accepted as a marker for chronic subclinical inflammation and is raised in diabetic subjects. Among the carbohydrates the dietary fiber are claimed to have a unique role in determining insulin secretion or sensitivity. The role of high fiber carbohydrates in influencing insulin sensitivity in randomized feeding studies is found to

be inconsistent also. Our hypothesis was that persons consuming higher amount of dietary fiber would have lower concentrations of CRP. In addition, this study provides evidence that dietary fiber is associated with CRP concentrations. The mechanism between dietary fiber and inflammation is unclear. In a recent review article¹⁰, King suggested that dietary fiber decreases lipid oxidation, which in turn is associated with decreased inflammation. Normal bowel flora also contributes to a healthy intestinal environment, which helps to prevent inflammation¹⁰. The antiinflammatory effects of fiber are intriguing, because prior work had focused on the ability of fiber to reduce other substances that cause inflammation (eg, the inhibition of hyperglycemia and its effects on lipids, particularly LDL cholesterol).

The relation of dietary patterns and CRP have been explored in some other studies^{16,23}. In conclusion, this study provides important information about the relation between dietary fiber and CRP. Increased consumption of dietary fiber appears to be strongly associated with lower CRP concentrations and vice versa.

Conclusion: The study revealed that CRP, an inflammatory marker, in type 2 diabetic subjects is significantly more in subjects taking less dietary fiber compared to diabetic subjects taking more dietary fiber. This dietary fiber maybe is the possible causal factor of raised inflammatory marker more in diabetic patients who are taking less dietary fiber.

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